

TIPS FOR THE LEVEL 2 HEALTH AND SAFETY PLAN (HASP)

This page presents tips for word processing the Level 2 HASP form. This page is not part of the HASP. The *boilerplate* text of the form should never be changed and is issued in read-only format. After revising the form, save the revised document under a new name. **Save your work frequently.**

WARNING: Work slowly and carefully. Print this page out now so you have the following instructions while you work on the form. Delete this page when you are finished working on the HASP form.

- ✓ **RED** text contains instructions or sample text only. Red text should be deleted and formatted in black throughout the document after information is added.
- ✓ Double-click or right-click on any box and then select the “checked” option to enter an X. The boxes are set up to center the text both horizontally and vertically.
- ✓ Most of this document is set up in table format. A table row may be preset to a specific size, and not all text within the row will be displayed. When not all text is displayed, place the cursor in the row in question.

Additional Comments:

- ✓ HASPs should be submitted to your Regional Safety Officer (RSO) or by emailing to EMI.HaspApprovers.com for review and approval prior to the start of operations.
- ✓ Ensure that all subcontractors have been pre-qualified prior to submission for HASP approval. If you are unsure a subcontractor is currently pre-qualified, please visit the health and safety website at: <http://home.ttemi.com/High%20Hazard%20Subcontractor%20Docu/default.aspx>.
- ✓ Subcontractor and persons from other organizations that will be following this HASP must be identified by name where applicable and sign the Approval and Sign-off Form.
- ✓ This HASP may be completed electronically or by hand, as necessary to ensure that a complete HASP is available to support the project.
- ✓ All blanks should be filled in with appropriate information or marked as not applicable (NA)
- ✓ Mark all applicable items with an X in the box in sections that contain lists and boxes to check.
- ✓ **The HASP must be reviewed and approved before any work can begin on site.** After the initial project work, data and subsequent decisions related to health and safety may be recorded in the field log book.
- ✓ An amendment is required when changes that were not within contingency plans are made or a new task is added to Tetra Tech’s scope of work. A signature by a HASP approver is also required for amendments.
- ✓ An approved copy of the HASP must be kept on jobsites at all times Tetra Tech personnel are present. **Failure to have an approved HASP on site at all times will lead to disciplinary actions.**
- ✓ The HASP located on the jobsite must contain signatures from each person entering the jobsite signifying review and acceptance of the plan.
- ✓ Personnel who prepare an HASP must be familiar with the requirements stated in the *START Health and Safety Plan Approval Procedures* document, dated September 19, 2001.

Rights and Responsibilities

- ✓ All personnel working on Tetra Tech projects are expected to and responsible for reporting safety hazards they face while performing their work. As such, reports of safety hazards are viewed as positive interactions and no employee of Tetra Tech EMI will retaliate against anyone who reports a safety hazard.
- ✓ Tetra Tech employees have the right to refuse to perform work involving significant safety hazards they feel have not been addressed.
- ✓ All personnel working on Tetra Tech projects have the right to stop work if they feel any worksite condition, practice, or operation causes or presents a hazard that can reasonably be expected to result in immediate death, serious physical harm, or severe damage to the environment.

Attachments to the HASP

- ✓ Daily Tailgate Safety Meeting form (to be completed at the beginning of each day and stored with the HASP onsite)
- ✓ OSHA VPP Info sheet for review on jobsites
- ✓ HASP Amendment Form (to be completed when new tasks are added to Tetra Tech’s scope of work, an existing HASP changes substantially, or new hazards are encountered on the jobsite)
- ✓ Form AF-1 (Field Audit Checklist to be completed once per week onsite and submitted to your Regional Safety Officer)
- ✓ Activity Hazard Analysis (AHA) template

Site Name: Highland Park warehouse	Site Contact: Lori Kozel	Telephone: 586-524-0613
Location: 14310 Hamilton Avenue, Highland Park, MI	Client Contact: Jeff Kimble	Telephone: 734-692-7684
EPA ID No.	Prepared By: Kevin Scott	Date Prepared: 2.10.16
Project No. TBD	Dates of Activities: Begin 2.10.2016	Emergency Response <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No

Objectives: <ul style="list-style-type: none"> Assist OSC with air monitoring and runoff and air, soil and water sampling 	Site Type: <i>Check as many as applicable.</i> <table style="width: 100%;"> <tr> <td><input checked="" type="checkbox"/> Active</td> <td><input type="checkbox"/> Landfill</td> <td><input type="checkbox"/> Inner-City</td> </tr> <tr> <td><input type="checkbox"/> Inactive</td> <td><input type="checkbox"/> Railroad</td> <td><input checked="" type="checkbox"/> Rural</td> </tr> <tr> <td><input type="checkbox"/> Secured</td> <td><input checked="" type="checkbox"/> Residential</td> <td><input type="checkbox"/> Remote</td> </tr> <tr> <td><input checked="" type="checkbox"/> Unsecured</td> <td><input checked="" type="checkbox"/> Industrial</td> <td><input type="checkbox"/> Other (<i>specify</i>)</td> </tr> </table>	<input checked="" type="checkbox"/> Active	<input type="checkbox"/> Landfill	<input type="checkbox"/> Inner-City	<input type="checkbox"/> Inactive	<input type="checkbox"/> Railroad	<input checked="" type="checkbox"/> Rural	<input type="checkbox"/> Secured	<input checked="" type="checkbox"/> Residential	<input type="checkbox"/> Remote	<input checked="" type="checkbox"/> Unsecured	<input checked="" type="checkbox"/> Industrial	<input type="checkbox"/> Other (<i>specify</i>)
<input checked="" type="checkbox"/> Active	<input type="checkbox"/> Landfill	<input type="checkbox"/> Inner-City											
<input type="checkbox"/> Inactive	<input type="checkbox"/> Railroad	<input checked="" type="checkbox"/> Rural											
<input type="checkbox"/> Secured	<input checked="" type="checkbox"/> Residential	<input type="checkbox"/> Remote											
<input checked="" type="checkbox"/> Unsecured	<input checked="" type="checkbox"/> Industrial	<input type="checkbox"/> Other (<i>specify</i>)											

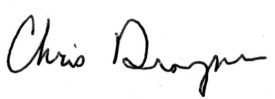
Project Scope of Work and Site Background

START is tasked to assist EPA OSC and local FD with air monitoring and sampling at an ongoing fire at a warehouse located at 14310 Hamilton in Highland Park, Michigan. Fire companies responded to a massive fire at the warehouse. The press noted that explosions were heard coming from the building as the fire burned, which could be from tanks of fuel or other material in the building. According to the news, the fire was announced as being under control shortly before 8 a.m., but it was still burning. The flames could take about a week to fight, according to Highland Park Fire Chief

According to online Wayne County Assessor's records, there are eight parcels and. The business that pay taxes on the property include: Hamilton Avenue Property, Helm, Technology Investment Partners, Williams Scotsman/Marvin F. Power & Co. Helm Promotions, Automatic Data Processing, Americor Capital and Total Vending and Coffee Service.

Health and Safety Approver Comments or Additional Instructions: This HASP **MUST** be revised if entry into the fire-damaged facility is required, contact Safety Manager immediately. Always use the buddy system when conducting reconnaissance and monitoring. Stay clear and in visual contact with heavy equipment operators.

See included guide for particulates at fires.


 Health and Safety Plan Approver Signature:

APPROVED
 By Chris Draper at 2:53 pm, Feb 10, 2016

Date:

Note: A minimum of two persons with appropriate training and medical surveillance must be on site for any fieldwork subject to Level 2 HASP requirements.

Note: A detailed site sketch or figure may be included on Page 10 of 12.

Initial Isolation and Protective Action Distances (for emergency response operations only): N

Establishment of Work Zones; including exclusion, contamination reduction, and support zones; is required for ALL HAZWOPER projects. For heavy equipment (i.e. drilling operations), exclusions zone will established around each equipment or drilling location based on site conditions and or noise levels (DCN 2-04, Hearing Conservation Program) at drilling operations (i.e. a circular exclusion zone based on noise levels >85 dbA from the drill rig or a minimum of 20 feet around the rig, whichever is greater). Work zones will be delineated using cones, barrier tape or similar visual indicators. The building interior will be considered the exclusion zone.

ALL investigation-derived waste shall be drummed and remain onsite pending characterization for subsequent disposal.

Spill control shall be conducted in accordance with of SWP 5-14, *Spill and Discharge Control Practices*, and SWP 05-47, *Spill Prevention and Clean Up*.

Based of forecast for 2/10/16					
Wind Speed and Direction (Approach from upwind)		Temperature (°F)	Relative Humidity (%)	Probability of Precipitation (%)	Weather Forecast (such as partly cloudy, snow, etc.)
Speed (mph): 12	From Direction: NW	20	72	60	cloudy

On-Site Supplies: ☒ First Aid Kit ☒ Fire Extinguisher ☐ Air Horn ☒ Oral Thermometer ☐ Noise Dosimeter

Known or Anticipated Site Hazards or Concerns: (Hazards covered by existing Safe Work Practices are listed on the next page)

<input type="checkbox"/> Work on active roadway	<input checked="" type="checkbox"/> Overhead utilities	<input checked="" type="checkbox"/> Energized electrical systems
<input type="checkbox"/> Onsite laboratory	<input checked="" type="checkbox"/> Buried Utilities	<input checked="" type="checkbox"/> Portable hand tool use
<input checked="" type="checkbox"/> Explosion or fire hazard	<input type="checkbox"/> Surface or underground storage tanks	<input checked="" type="checkbox"/> Portable electrical tool use
<input checked="" type="checkbox"/> Oxygen deficiency	<input checked="" type="checkbox"/> General slips, trips, falls	<input type="checkbox"/> Machine guarding
<input checked="" type="checkbox"/> Unknown or poorly characterized chemical hazards	<input checked="" type="checkbox"/> Uneven, muddy, rugged terrain	<input checked="" type="checkbox"/> Portable fire extinguisher use
<input checked="" type="checkbox"/> Inorganic chemicals	<input type="checkbox"/> Lift (man lift, cherry picker) use	<input type="checkbox"/> Driving commercial vehicles
<input checked="" type="checkbox"/> Organic chemicals	<input type="checkbox"/> Industrial truck (forklift) use	<input type="checkbox"/> Driving personal vehicles
<input type="checkbox"/> Chemical warfare material	<input type="checkbox"/> Wood or metal ladder use	<input type="checkbox"/> Scientific diving operations
<input type="checkbox"/> Compressed Gas Cylinders	<input type="checkbox"/> Dangerous goods shipped by air	<input type="checkbox"/> Injury and Illness Prevention Program (California only)
<input checked="" type="checkbox"/> Asbestos	<input type="checkbox"/> Elevated work (over 6' high)	<input type="checkbox"/> Ergonomics (California only)
<input checked="" type="checkbox"/> Respirable particulates	<input checked="" type="checkbox"/> Heavy equipment use or operation	<input type="checkbox"/> Work in strip or shaft mines
<input type="checkbox"/> Respirable silica	<input checked="" type="checkbox"/> Construction work	<input type="checkbox"/> Client-specific safety requirements (attach to HASP)
<input type="checkbox"/> Non-ionizing radiation (lasers, radiofrequencies, UV)	<input type="checkbox"/> Benching, shoring, bracing	<input type="checkbox"/> Methamphetamine lab
<input type="checkbox"/> Ionizing radiation (alpha, beta, gamma, etc.)	<input type="checkbox"/> Scaffold use	<input type="checkbox"/> Working over or near water
<input type="checkbox"/> Heat stress	<input checked="" type="checkbox"/> High noise	<input type="checkbox"/> Mold
<input checked="" type="checkbox"/> Cold stress	<input type="checkbox"/> Grinding operations	<input type="checkbox"/> Other (insert)

Explosion or Fire Potential: ☒ High ☐ Medium ☐ Low ☐ Unknown

Chemical Products Tetra Tech EM Inc. Will Use or Store On Site: (Attach a Material Safety Data Sheet [MSDS] for each item.)

- | | | | |
|--|---|--|---|
| <input checked="" type="checkbox"/> Alconox or liquinox | <input type="checkbox"/> Calibration gas (Methane) | <input type="checkbox"/> Hydrogen gas | <input type="checkbox"/> Isopropyl alcohol |
| <input type="checkbox"/> Hydrochloric acid (HCl) | <input checked="" type="checkbox"/> Calibration gas (Isobutylene) | <input type="checkbox"/> Household bleach (NaOCl) | <input checked="" type="checkbox"/> HazCat Kit |
| <input type="checkbox"/> Nitric acid (HNO ₃) | <input type="checkbox"/> Calibration gas (Pentane) | <input type="checkbox"/> Sulfuric acid (H ₂ SO ₄) | <input type="checkbox"/> Mark I Kits (<i>number?</i>) _____ |
| <input type="checkbox"/> Sodium hydroxide (NaOH) | <input checked="" type="checkbox"/> Calibration gas (4-gas mixture) | <input type="checkbox"/> Hexane | <input checked="" type="checkbox"/> Eyewash / drench water |

WARNING: Eyewash solution shall be readily available on ALL projects where corrosives (acids or bases) are used, including sample preservatives

Applicable Safety Programs and Safe Work Practices (SWP). Attach to HASP:

- ☐ DCN 4-03 Demolition and Decontamination
- ☐ DCN 4-05 Trenching and Excavation Safety
- ☐ DCN 4-08 Asbestos Protection Program
- ☐ DCN 4-09 Haulage and Earth Moving
- ☐ DCN 4-10 Lead Protection Program
- ☒ SWP DCN 5-01 General Safe Work Practices
- ☒ SWP DCN 5-02 General Safe Work Practices HAZWOPER
- ☐ SWP DCN 5-03 Safe Work Practices for Office Employees
- ☐ SWP DCN 5-04 Safe Drilling Practices
- ☐ SWP DCN 5-05 Safe Direct Push (GeoProbe) Practices
- ☐ SWP DCN 5-06 Working Over or Near Water
- ☐ SWP DCN 5-07 Use of Heavy Equipment
- ☐ SWP DCN 5-08 Special Site Hazards (Firearms, Remote Sites, Mines, aircraft, etc.)
- ☐ SWP DCN 5-09 Safe Electrical Work Practices
- ☐ SWP DCN 5-10 Fall Protection Practices
- ☐ SWP DCN 5-11 Portable Ladder Safety
- ☐ SWP DCN 5-12 Drum and Container Handling Practices
- ☒ SWP DCN 5-13 Flammable Hazards and Ignition Sources
- ☒ SWP DCN 5-14 Spill and Discharge Control Practices
- ☐ SWP DCN 5-15 Heat Stress
- ☒ SWP DCN 5-16 Cold Stress
- ☒ SWP DCN 5-17 Biohazards
- ☐ SWP DCN 5-18 Underground Storage Tank Removal Practices
- ☒ SWP DCN 5-19 Safe Lifting Procedures
- ☐ SWP DCN 5-22 Hydrographic Data Collection
- ☐ SWP DCN 5-23 Permit-Required Confined Space Entry Practices
- ☐ SWP DCN 5-24 Non-Permit-Required Confined Space Entry Practices
- ☒ SWP DCN 5-26 Prevention of Sun Exposure
- ☒ SWP DCN 5-27 Respirator Cleaning Practices
- ☒ SWP DCN 5-28 Safe Use Practices for Use of Respirators
- ☐ SWP DCN 5-29 Respirator Qualitative Fit Testing Procedures
- ☒ SWP DCN 5-47, Spill Prevention and Clean Up

Tasks Performed At Job Site that are NOT Covered by SWPs

NOTE: Many AHA's can be found on the Health & Safety intranet site at:
<http://home.ttemi.com/C18/Activity%20Hazard%20Analysis%20Docum/default.aspx>

Attach Activity Hazard Analysis (AHA) for each non-covered task

- ☒ Site Inspection
- ☐ Hazard Categorization and Sampling of Unknowns
- ☒ Site Documentation – Observation of Excavation Operations Near Heavy Equipment
- ☐ Soil Sampling (Augering)
- ☒ Project Documentation and Air Monitoring

Tetra Tech Employee Training and Medical Requirements:
Basic Training and Medical

- ☒ Initial 40 Hour Training
- ☒ 8-Hour Supervisor Training (one-time)
- ☒ Current 8-Hour Refresher Training
- ☒ Current Medical Clearance (including respirator use)
- ☒ Current First Aid Training
- ☒ Current CPR Training
- ☒ Current Respirator Fit-Test

Other Specific Training and Medical Surveillance Requirements

- ☐ Confined Space Training
- ☐ Level A Training
- ☐ Radiation Training
- ☐ OSHA 10-hour Construction Safety Training
- ☐ OSHA 30-hour Construction Safety Training
- ☐ Asbestos Awareness Training
- ☐ Asbestos B-Reader X-Ray
- ☐ Blood Lead Level and ZPP Pre, during and Post-Project
- ☐ Urinary Arsenic Level Pre and Post-Project
- ☐ Other _____
- ☐ Other _____

Materials Present or Suspected at Site	Highest Observed Concentration (specify units and sample medium)	Exposure Limit (specify ppm or mg/m ³)	IDLH Level (specify ppm or mg/m ³)	Primary Hazards of the Material (explosive, flammable, corrosive, toxic, volatile, radioactive, biohazard, oxidizer, or other)	Symptoms and Effects of Acute Exposure	Photoionization Potential (eV)
Carbon Monoxide	Unknown	PEL = 50 ppme REL = 35 ppm (30-min) TLV =	1,200 ppm	Toxic	Headache, tachypnea, nausea, lassitude, dizziness, confusion, hallucinations; cyanosis; depressed S-T segment of electrocardiogram, angina, syncope	14.01
Hydrogen Chloride	Unknown	PEL = 5 ppm (C) REL = 5 ppm (C)	50 ppm	Toxic; corrosive	Irritation nose, throat, larynx; cough, choking; dermatitis; solution: eye, skin burns; liquid: frostbite; in animals: laryngeal spasm; pulmonary edema	12.74
PAHs	Unknown	PEL = TWA 0.2 mg/m ³ REL = CARC TWA 0.1 mg/m ³ [Skin] Hazard <input checked="" type="checkbox"/>	CARC [80 mg/m ³]	Toxic; [potential occupational carcinogen]	Dermatitis, bronchitis, [potential occupational carcinogen]	NA

Specify Information Sources: NIOSH Pocket Guide to Hazardous Chemicals, September 2005

Note: In the Exposure Limit column, include Ceiling (C) and Short-Term Exposure Limits (STEL) if they are available. Also, use the following short forms and abbreviations to complete the table above.

A = Air
CARC = Carcinogenic
eV = Electron volt
U = Unknown

IDLH = Immediately dangerous to life or health
mg/m³ = Milligram per cubic meter
NA = Not available
NE = None established

PEL = Permissible exposure limit
ppm = Part per million
REL = Recommended exposure limit
S = Soil

TLV = Threshold limit value

Note: If no contingency level of protection is selected, all employees covered under this plan must evacuate the immediate site area if air contaminant levels require upgrading PPE. Level A field work requires a Level 3 HASP. This information is available on the chemical hazards page of this HASP.

Field Activities Covered Under this HASP:

Task Description	Level of Protection ¹		Date of Activities
	Primary	Contingency	
1 Collect Air and Runoff samples	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input checked="" type="checkbox"/> D	<input type="checkbox"/> A <input type="checkbox"/> B <input checked="" type="checkbox"/> C <input type="checkbox"/> D	Begin 2.10.2016
2 Conduct Air monitoring	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input checked="" type="checkbox"/> D	<input type="checkbox"/> A <input type="checkbox"/> B <input checked="" type="checkbox"/> C <input type="checkbox"/> D	
3 HAZCAT (STOP – contact Chris Burns)	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	
4 Enter fire-damaged facility (STOP – contact Chris Burns)	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	
5	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	<input type="checkbox"/> A <input type="checkbox"/> B <input type="checkbox"/> C <input type="checkbox"/> D	

Site Personnel and Responsibilities (include subcontractors):

Employee Name and Office Code / Location	Task(s)	Responsibilities
Lori Kozel	Project Manager	<ul style="list-style-type: none"> Project Manager: Manages the overall project, makes site safety coordinator (SSC) aware of pertinent project developments and plans, and maintains communications with client as necessary. Additionally, For projects lasting longer than one consecutive week on-site, the PM is responsible for conducting one field audit using Form AF-1.
Lori Kozel	Field Team Leader	<ul style="list-style-type: none"> Field Team Leader: Directs field activities, makes site safety coordinator (SSC) aware of pertinent project developments and plans, and maintains communications with the Project Manager and the client as necessary
Kelly Thomas	SSC, Field Personnel	<ul style="list-style-type: none"> Site Safety Coordinator (SSC): Ensures that appropriate personal protective equipment (PPE) is available, enforces proper use of PPE by on-site personnel and subcontractors; suspends investigative work if personnel are or may be exposed to an immediate health hazard; implements and enforces the HASP; identifies and controls site hazards when possible; communicates site hazards to all personnel; and reports any deviations observed from anticipated conditions described in the health and safety plan to the health and safety representative. Alternate Site Safety Coordinator (if any) Field Personnel: Completes tasks as directed by the project manager, field team leader, and SSC, and follows the HASP and all SWPs and guidelines established in the Tetra Tech, Inc., Health and Safety Manual. Tetra Tech-hired subcontractor personnel on site (a subcontract SSC MUST be identified by name): Completes tasks as outlined in the project scope of work in accordance with the contract. Participates in all Tetra Tech on-site safety meetings and follows all procedures and guidelines established in this HASP, as well as the company health and safety plan and program.

Note:

- See next page for details on levels of protection

NOTE: Contingency level of protection section should be completed only if the upgraded level of protection is immediately available at the job site. If no contingency level of protection is denoted, all employees covered under this HASP must evacuate the immediate site area if air contaminant levels would require an upgrade of PPE.

Protective Equipment: (Indicate type or material as necessary for each task.)

Task	Primary Level of Protection (A,B,C,D)	PPE Component Description (Primary)	Contingency Level of Protection (A, B, C, D)	PPE Component Description (Contingency)
1	D	Respirator type: Cartridge type (if applicable): CPC material: Tyvel coverall (recommended) Glove material(s): Nitrile Boot material: Leather Steel-toe; butyl rubber overboots (optional) Other: Safety glasses, hardhat, high-visibility vest, hearing protection near heavy equipment	C	Respirator type: SCOTT AV3000 Cartridge type (if applicable): GME P100 CPC material: Tychem RC Glove material(s) Solvex and Nitrile for incidental protection only; butyl rubber for full protection Boot material: Leather Steel-toe; butyl rubber overboots (optional) Other: Hardhat, high-visibility vest, hearing protection near heavy equipment
2	D	Respirator type: Cartridge type (if applicable): CPC material: Tyvel coverall (recommended) Glove material(s): Nitrile Boot material: Leather Steel-toe; butyl rubber overboots (optional) Other: Safety glasses, hardhat, high-visibility vest, hearing protection near heavy equipment	C	Respirator type: SCOTT AV3000 Cartridge type (if applicable): GME P100 CPC material: Tychem RC Glove material(s) Solvex and Nitrile for incidental protection only; butyl rubber for full protection Boot material: Leather Steel-toe; butyl rubber overboots (optional) Other: Hardhat, high-visibility vest, hearing protection near heavy equipment
3	B	Respirator type: SCBA Cartridge type (if applicable): Supplied Air CPC material: Tychem RC Glove material(s) Solvex and Nitrile for incidental protection only; butyl rubber for full protection Boot material: Leather Steel-toe; butyl rubber overboots (optional) Other: Hardhat, high-visibility vest, hearing protection near heavy equipment	C	Respirator type: SCOTT AV3000 Cartridge type (if applicable): GME P100 CPC material: Tychem RC Glove material(s) Solvex and Nitrile for incidental protection only; butyl rubber for full protection Boot material: Leather Steel-toe; butyl rubber overboots (optional) Other: Hardhat, high-visibility vest, hearing protection near heavy equipment
4	B	Respirator type: SCBA Cartridge type (if applicable): Supplied Air CPC material: Tychem RC Glove material(s) Solvex and Nitrile for incidental protection only; butyl rubber for full protection Boot material: Leather Steel-toe; butyl rubber overboots (optional) Other: Hardhat, high-visibility vest, hearing protection near heavy equipment	C	Respirator type: SCOTT AV3000 Cartridge type (if applicable): GME P100 CPC material: Tychem RC Glove material(s) Solvex and Nitrile for incidental protection only; butyl rubber for full protection Boot material: Leather Steel-toe; butyl rubber overboots (optional) Other: Hardhat, high-visibility vest, hearing protection near heavy equipment

Respirator Notes:

Respirator cartridges may only be used for a maximum time of 8 hours or one work shift, whichever is less, and must be discarded at that time. For job sites with organic vapors, respirator cartridges may be used as described in this note as long as the concentration is less than 200 parts per million (ppm), the boiling point is greater than 70 °Celsius, and the relative humidity is less than 85 percent. If any of these levels are exceeded, a site-specific respirator cartridge change-out schedule must be developed and included in the HASP using Tetra Tech Form RP-2 (Respiratory Hazard Assessment Form)

Notes:

All levels of protection must include eye, head, and foot protection.

CPC = Chemical protective clothing

Thermoluminescent Dosimeter (TLD) Badges must be worn during all field activities on sites with radiation hazards. TLDs must be worn under CPC.

Monitoring Equipment: All monitoring equipment on site must be calibrated before and after each use and results recorded in the site logbook				
Instrument (Check all required)	Task	Instrument Reading	Action Guideline	Comments
<input checked="" type="checkbox"/> Combustible gas indicator model:	<input checked="" type="checkbox"/> 1	0 to 10% LEL	Monitor; evacuate if confined space	
	<input type="checkbox"/> 2			
	<input type="checkbox"/> 3	10 to 25% LEL	Potential explosion hazard; notify SSC	
	<input type="checkbox"/> 4			
	<input type="checkbox"/> 5	>25% LEL	Explosion hazard; interrupt task; evacuate site; notify SSC	
<input checked="" type="checkbox"/> Oxygen meter model:	<input checked="" type="checkbox"/> 1	>23.5% Oxygen	Potential fire hazard; evacuate site	
	<input type="checkbox"/> 2			
	<input type="checkbox"/> 3	23.5 to 19.5% Oxygen	Oxygen level normal	
	<input type="checkbox"/> 4			
	<input type="checkbox"/> 5	<19.5% Oxygen	Oxygen deficiency; interrupt task; evacuate site; notify SSC	
<input checked="" type="checkbox"/> Radiation survey meter model:	<input checked="" type="checkbox"/> 1	Normal background	Proceed	Annual exposure not to exceed 1,250 mrem per quarter Background reading must be taken in an area known to be free of radiation sources.
	<input type="checkbox"/> 2			
	<input type="checkbox"/> 3	Two to three times background	Notify SSC	
	<input type="checkbox"/> 4			
	<input type="checkbox"/> 5	>Three times background	Radiological hazard; interrupt task; evacuate site; notify RSO	
<input checked="" type="checkbox"/> Photoionization detector model: <input type="checkbox"/> 11.7 eV <input checked="" type="checkbox"/> 10.6 eV <input type="checkbox"/> 10.2 eV <input type="checkbox"/> 9.8 eV <input type="checkbox"/> Other (specify): _____	<input checked="" type="checkbox"/> 1	Any response above background to 5 ppm above background	Level B is recommended Level C ^a may be acceptable	These action levels are for unknown gases or vapors. After the contaminants are identified, action levels should be based on the specific contaminants involved.
	<input type="checkbox"/> 2			
	<input type="checkbox"/> 3	> 5 to 500 ppm above background	Level B	
	<input type="checkbox"/> 4			
	<input type="checkbox"/> 5	> 500 ppm above background	Level A	
<input checked="" type="checkbox"/> Cyanide monitor:	<input checked="" type="checkbox"/> 1	Any response above background	Level B is recommended. Cover open vats, drums and ventilate mechanically	These action levels are HCN gas
	<input type="checkbox"/> 2			
	<input type="checkbox"/> 3			
	<input type="checkbox"/> 4	>2 ppm	Level B	
	<input type="checkbox"/> 5			
<input type="checkbox"/> Detector tube models:	<input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5	Specify: < 1/2 the PEL > 1/2 the PEL	Specify:	The action level for upgrading the level of protection is one-half of the contaminant's PEL. If the PEL is reached, evacuate the site and notify a safety specialist

Notes:

eV= electron volt

LEL=Lower explosive limit

mrem=Millirem

PEL=Permissible exposure limit

ppm=Part per million

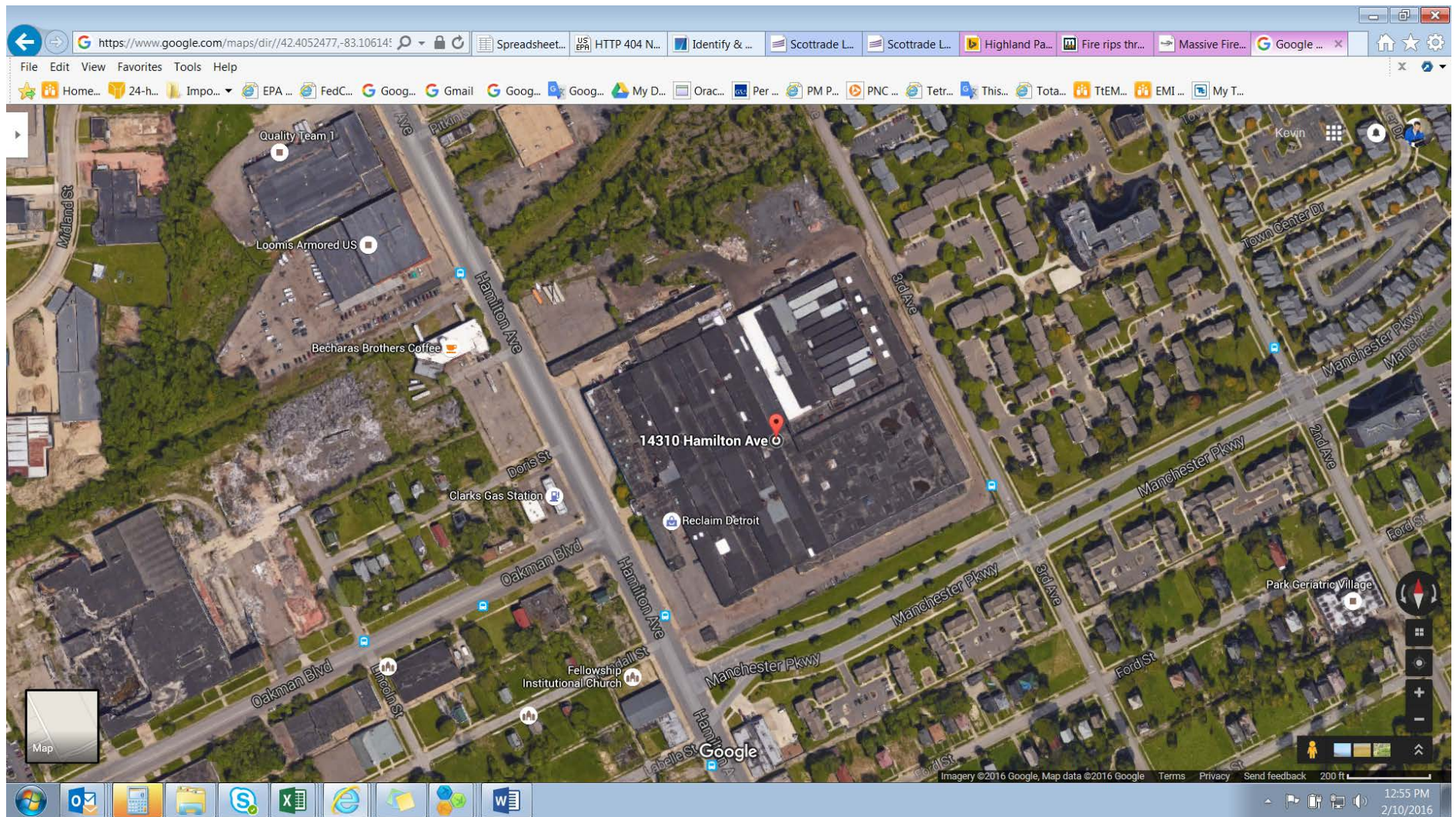
a. Level B is required when chemical hazards are present, but are uncharacterized. Level C may be acceptable for certain tasks in some situations. If you are uncertain, consult your RSO.

Project-Specific Industrial Hygiene Requirements	Emergency Contacts: Telephone No.																		
OSHA-Regulated Chemicals*: <i>Check any present on the job site in any medium (air, water, soil)</i> <div style="margin-top: 5px;"> <input type="checkbox"/> No chemicals below are located on the job site <input type="checkbox"/> Friable Asbestos <input type="checkbox"/> Silica, crystalline <input type="checkbox"/> alpha-Naphthylamine <input type="checkbox"/> Methyl chloromethyl ether <input type="checkbox"/> 3,3'-Dichlorobenzidine (and its salts) <input type="checkbox"/> bis-Chloromethyl ether <input type="checkbox"/> beta-Naphthylamine <input type="checkbox"/> Benzidine <input type="checkbox"/> 4-Aminodiphenyl <input type="checkbox"/> Ethyleneimine <input type="checkbox"/> beta-Propiolactone <input type="checkbox"/> 2-Acetylaminoflourene <input type="checkbox"/> 4-Dimethylaminoazobenzene <input type="checkbox"/> N-nitrosomethylamine <input type="checkbox"/> Vinyl chloride <input type="checkbox"/> Inorganic arsenic <input type="checkbox"/> Lead <input type="checkbox"/> Chromium (VI) <input type="checkbox"/> Cadmium <input type="checkbox"/> Benzene <input type="checkbox"/> Coke oven emissions <input type="checkbox"/> 1,2-Dibromo-3-chloropropane <input type="checkbox"/> Acrylonitrile <input type="checkbox"/> Ethylene oxide <input type="checkbox"/> Formaldehyde <input type="checkbox"/> Methylenedianiline <input type="checkbox"/> 1,3-Butadiene <input type="checkbox"/> Methylene chloride </div> <div style="margin-top: 10px;"> <p>* NOTE: Many states, including California and New Jersey, have chemical-specific worker protection requirements and standards for many chemicals and known or suspected carcinogens.</p> </div>	<div style="margin-top: 5px;"> WorkCare and Incident Intervention 888.449.7787, or 800.455.6155 Tetra Tech EMI 24-hour Anonymous Hazard Reporting Line 866.383.8070 U.S. Coast Guard National Response Center 800.424.8802 InfoTrac 800.535.5053 Poison Control 800.222.1222 Fire department 911 Police department 911 </div> <div style="margin-top: 10px;"> <p>Personnel Call-Down List:</p> <table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: left;">Job Title or Position:</th> <th style="text-align: left;">Name</th> <th style="text-align: left;">Cell Phone:</th> </tr> </thead> <tbody> <tr> <td>Regional Safety Manager</td> <td>Chris Draper</td> <td>615.969.1334</td> </tr> <tr> <td>Project Manager:</td> <td>Lori Kozel</td> <td>586-524-0613</td> </tr> <tr> <td>Field Team Leader:</td> <td>Lori Kozel</td> <td>586-247-6072</td> </tr> <tr> <td>Site Safety Coordinator (SSC):</td> <td>Kelly Thomas</td> <td>313-574-3176</td> </tr> <tr> <td>Subcontractor SSC:</td> <td></td> <td></td> </tr> </tbody> </table> </div> <div style="margin-top: 10px;"> <p>Medical and Site Emergencies:</p> <p>Signal a site or medical emergency with three blasts of a loud horn (car horn, fog horn, or similar device). Site personnel should evacuate to the area of safe refuge designated on the site map.</p> <p>Hospital Name: DMC Harper University Hospital</p> <p>Address: 3990 John R Street, Detroit, MI 48201</p> <p>General Phone: (313) 745-8040 Emergency Phone: 911 Ambulance Phone: 911</p> <p>Hospital called to verify emergency services are offered? Clinic open 24/7 YES <input type="checkbox"/> NO <input type="checkbox"/></p> <p>Step-by-step Route to Hospital: (see Page 11 of 12 for route map)</p> </div>	Job Title or Position:	Name	Cell Phone:	Regional Safety Manager	Chris Draper	615.969.1334	Project Manager:	Lori Kozel	586-524-0613	Field Team Leader:	Lori Kozel	586-247-6072	Site Safety Coordinator (SSC):	Kelly Thomas	313-574-3176	Subcontractor SSC:		
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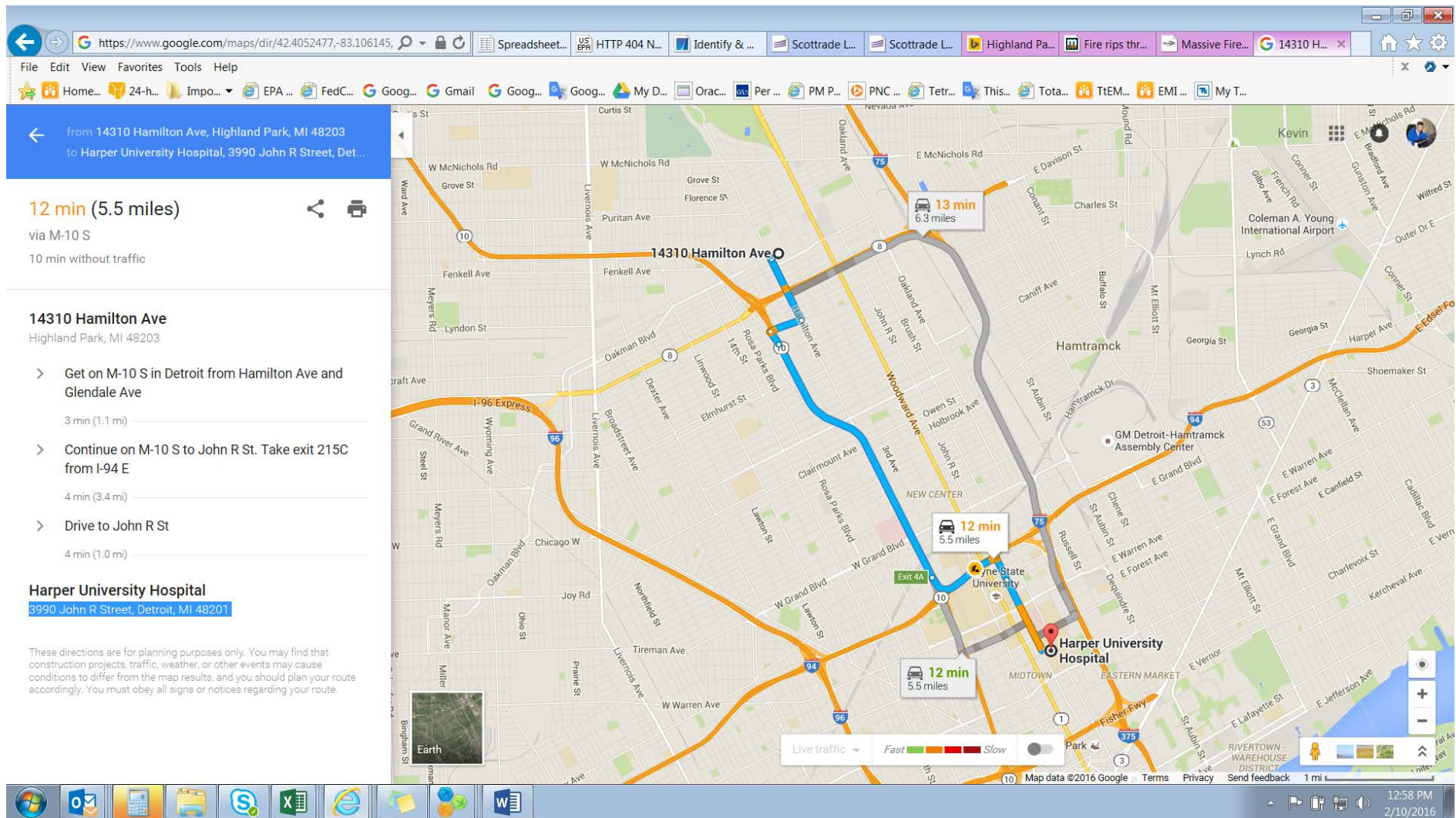
Note: This page must be posted on site.

Decontamination Procedures		Emergency Response Planning
<p>The site safety coordinator oversees implementation of project decontamination procedures and is responsible for ensuring they are effective.</p>		<p>During the pre-work briefing and daily tailgate safety meetings, all on-site employees will be trained in the provisions of emergency response planning, site communication systems, and site evacuation routes.</p>
<p>Personnel Decontamination</p> <p>Level D Decon - <input type="checkbox"/> Wet <input checked="" type="checkbox"/> Dry</p> <p>Level C Decon - <input type="checkbox"/> Wet <input checked="" type="checkbox"/> Dry</p> <p>Level B Decon – Briefly outline the level B decontamination methods to be used on a separate page attached to this HASP.</p> <p>Level A Decon – A Level 3 HASP is required. Notify your regional health and safety representative and health and safety director.</p> <p>Equipment Decontamination</p> <p>All tools, equipment, and machinery from the Exclusion Zone (hot) or Contamination Reduction Zone (warm) are decontaminated in the CRZ before they are removed to the Support Zone (cold). Equipment decontamination procedures are designed to minimize the potential for hazardous skin or inhalation exposure, cross-contamination, and chemical incompatibilities.</p> <p>Respirator Decontamination</p> <p>Respirators are decontaminated in compliance with SWP 5-27 and should be included with this HASP.</p> <p>Waste Handling for Decontamination</p> <p>Procedures for decontamination waste disposal meet all applicable local, state, and federal regulations.</p>	<p>Decontamination Equipment</p> <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <input type="checkbox"/> Washtubs <input checked="" type="checkbox"/> Buckets <input checked="" type="checkbox"/> Scrub brushes <input type="checkbox"/> Pressurized sprayer <input type="checkbox"/> Detergent [Type] <input type="checkbox"/> Solvent [Type] <input type="checkbox"/> Household bleach solution Concentration/Dilution: _____ </div> <div style="width: 50%;"> <input type="checkbox"/> Deionized water <input type="checkbox"/> Disposable sanitizer wipes <input type="checkbox"/> Facemask sanitizer powder <input type="checkbox"/> Wire brush <input checked="" type="checkbox"/> Spray bottle <input type="checkbox"/> Tubs / pools <input type="checkbox"/> Banner/barrier tape <input checked="" type="checkbox"/> Plastic sheeting <input type="checkbox"/> Tarps and poles <input checked="" type="checkbox"/> Trash bags <input type="checkbox"/> Trash cans <input checked="" type="checkbox"/> Duct tape <input checked="" type="checkbox"/> Paper towels <input checked="" type="checkbox"/> Folding chairs <input type="checkbox"/> Other </div> </div> <p>In the event of an emergency that necessitates evacuation of a work task area or the site, the following procedures will take place.</p> <ul style="list-style-type: none"> • The Tetra Tech SSC will contact all nearby personnel using the on-site communications to advise the personnel of the emergency. • The personnel will proceed along site roads to a safe distance upwind from the hazard source. • The personnel will remain in that area until the SSC or an authorized individual provides further instructions. <p>In the event of a severe spill or a leak, site personnel will follow the procedures listed below.</p> <ul style="list-style-type: none"> • Evacuate the affected area and relocate personnel to an upwind location. • Inform the Tetra Tech SSC, a Tetra Tech office, and a site representative immediately. • Locate the source of the spill or leak, and stop the flow if it is safe to do so. • Begin containment and recovery of spilled or leaked materials. • Notify appropriate local, state, and federal agencies. <p>In the event of severe weather, site personnel will follow the procedures listed below.</p> <ul style="list-style-type: none"> • Site work shall not be conducted during severe weather, including high winds and lightning. • In the event of severe weather, stop work, lower any equipment (drill rigs) and evacuate the affected area. • Severe weather may cause heat or cold stress. Refer to SWPs 5-15 and 5-16 for information on both. <p>All work-related incidents must be reported. According to TtEMI's reporting procedures, for non-emergency incidents you should:</p> <ul style="list-style-type: none"> • Notify WorkCare and Incident Intervention at 888.449.7787, or 800.455.6155 • Notify your Project Manager or Regional Safety Officer (RSO) via phone immediately. • Complete a "Tetra Tech Incident Report" (Form IR) within 24 hours and send it to your RSO. If an injury or illness has occurred, the Form IR-A and the WorkCare HIPAA form must be completed at the same time the Form IR is completed. 	

Site Map (May be drawn after crews arrive onsite or inserted using aerial photographs, site figures, etc.):



Hospital Route Map (attach or insert):



Note: A dry-run should be conducted to establish a physical location associated with the map included in the HASP. Verbal verification from the hospital emergency room should also be obtained to ensure that the hospital will accept chemically contaminated patients.

APPROVAL AND SIGN-OFF FORM

Project No.: 103X90260001

I have read, understood, and agree with the information set forth in this Health and Safety Plan and will follow the direction of the Site Safety Coordinator (SSC) as well as procedures and guidelines established in the Tetra Tech, Inc., Health and Safety Manual. I understand the training and medical requirements for conducting field work and have met these requirements.

Tetra Tech has prepared this plan solely for the purpose of the health and safety protection of Tetra Tech employees. Subcontractors, visitors, and others at the site, while required to read and follow the provisions outlined in this plan at a minimum, should refer to their safety program for specific information related to their health and safety protection.

Name	Company / Agency / Organization	Signature	Date
Lori Kozel	Tetra Tech		
Kelly Thomas	Tetra Tech		

I have read, understood, and agree with the information set forth in this Health and Safety Plan and comply with and will enforce this HASP, as well as procedures and guidelines established in the Tetra Tech, Inc., Health and Safety Manual.

Name	Project-Specific Position	Signature	Date
Brian Malone	Project Manager		
Brian Malone	Field Team Leader		
Wes Willimas	Site Safety Coordinator		
	Subcontractor SSC		

Tetra Tech has prepared this plan solely for the purpose of the health and safety protection of Tetra Tech employees. Subcontractors, visitors, and others at the site, while required to read, acknowledge and follow the provisions outlined in this plan at a minimum, should refer to their safety program for specific information related to health and safety.

Note: Use Additional sheets as necessary to ensure that all personnel sign and affirm this document.

Emergency Contacts

WorkCare - For issues requiring an Occupational Health Physician; assistance is available 24 hours per day, 7 days per week.

InfoTrac - For issues related to incidents involving the transportation of hazardous chemicals; this hotline provides accident assistance 24 hours per day, 7 days per week

U.S. Coast Guard National Response Center - For issues related to spill containment, cleanup, and damage assessment; this hotline will direct spill information to the appropriate state or region

Poison Control Center – For known or suspected poisoning.

Limitations:

The Level-Two HASP is not appropriate in some cases:

- Projects involving unexploded ordnance (UXO), radiation sources as the primary hazard, or known chemical/biological weapons site must employ the Level 3 HASP
- Projects of duration longer than 90 days may need a Level 3 HASP (consult your RSO)

Decontamination:

Decontamination Solutions for Chemical and Biological Warfare Agents^a: PPE and equipment can be decontaminated using 0.5 percent bleach (1 gallon laundry bleach to 9 gallons water) for biological agents (15 minutes of contact time for anthrax spores; 3 minutes for others) followed by water rinse for chemical and biological agents. In the absence of bleach, dry powders such as soap detergents, earth, and flour can be used. The powders should be applied and then wiped off using wet tissue paper. Finally, water and water/soap solutions can be used to physically remove or dilute chemical and biological agents. Do not use bleach solution on bare skin; use soap and water instead. Protect decontamination workers from exposure to bleach.

Decontamination for Radiological and Other Chemicals: Primary decontamination should use Alconox and water unless otherwise specified in chemical specific information resources. The effectiveness of radiation decontamination should be checked using a radiation survey instrument. Decontamination procedures should be repeated until the radiation meter reads less than 100 counts per minute over a 100-square-centimeter area when the probe is held 1 centimeter from the surface and moving slower than 2.5 centimeters per second.

Decontamination Corridor: The decontamination setup can be adjusted to meet the needs of the situation. The decontamination procedures can be altered to meet the needs of the specific situation when compound- and site-specific information is available.

Decontamination Waste: All disposable equipment, clothing, and decontamination solutions will be double-bagged or containerized in an acceptable manner and disposed of with investigation-derived waste.

Decontamination Personnel: Decontamination personnel should dress in the same level of PPE or one level below the entry team PPE level.

All investigation-derived waste should be left on site with the permission of the property owner and the EPA on-scene coordinator. In some instances, another contractor will dispose of decontamination waste and investigation-derived waste. DO NOT place waste in regular trash. DO NOT dispose of waste until proper procedures are established.

Notes:

^a Source: Jane's Information Group. 2002. *Jane's Chem-Bio Handbook*. Page 39.



TETRA TECH, INC.
DAILY TAILGATE SAFETY MEETING FORM

Date: _____ Time: _____ Project No.: _____

Client: _____ Site Location: _____

Site Activities Planned for Today: _____

Weather Conditions: _____

Safety Topics Discussed	
Protective clothing and equipment:	
Chemical and physical hazards:	
Emergency procedures:	
Equipment hazards:	
Other:	
Attendees	
Printed Name	Signature

Meeting Conducted by:

Name

Signature



TETRA TECH EM INC.
HEALTH AND SAFETY PLAN AMENDMENT

Site Name: _____

Amendment Date: _____

Purpose or Reason for Amendment: _____

Required Additional Safe Work Practices or Activity Hazard Analyses: _____

Required Changes in PPE: _____

Action Level Changes: _____

AMENDMENT APPROVAL

RSO or Designee	_____	_____	_____
	Name	Signature	Date

Site Safety Coordinator	_____	_____	_____
	Name	Signature	Date

Date presented during daily site safety meeting: _____



TETRA TECH, INC.
FIELD AUDIT CHECKLIST

Project Name: _____ Project No.: _____

Field Location: _____ Completed by: _____

Project Manager: _____ Site Safety Coordinator: _____

General Items		In Compliance?		
		Yes	No	NA
Health and Safety Plan Requirements				
1	Approved health and safety plan (HASP) on site or available			
2	Names of on-site personnel recorded in field logbook or daily log			
3	HASP compliance agreement form signed by all on-site personnel			
4	Material Safety Data Sheets on site or available			
5	Designated site safety coordinator physically present on jobsite			
6	Daily tailgate safety meetings conducted and documented on Form HST-2			
7	Documentation available proving compliance with HASP requirements for medical examinations, fit testing, and training (including subcontractors)			
8	HASP onsite matches scope of work being conducted			
9	Emergency evacuation plan in place and hospital located			
10	Exclusion, decontamination, and support zones delineated and enforced			
11	HASP attachments present onsite (VPP sheet, audit checklist, AHA, etc.)			
12	Illness and injury prevention program reports completed (California only)			
Emergency Planning				
13	Emergency telephone numbers posted			
14	Emergency route to hospital posted			
15	Local emergency providers notified of site activities			
16	Adequate safety equipment inventory available			
17	First aid provider and supplies available			
18	Eyewash solution available when corrosive chemicals are present			
Air Monitoring				
19	Monitoring equipment specified in HASP available and in working order			
20	Monitoring equipment calibrated and calibration records available			
21	Personnel know how to operate monitoring equipment and equipment manuals available on site			
22	Environmental and personnel monitoring performed as specified in HASP			

Safety Items		In Compliance?		
		Yes	No	NA
Personal Protection				
23	Splash suit, if required			
24	Chemical protective clothing, if required			
25	Safety glasses or goggles (always required)			
26	Gloves, if required			
27	Overboots, if required			
28	Hard hat (always required)			
29	High visibility vest, if required			
30	Hearing protection, if required			
31	Full-face respirator, if required			
Instrumentation				
32	Combustible gas meter and calibration notes			
33	Oxygen meter and calibration notes			
34	Organic vapor analyzer and calibration notes			
Supplies				
35	Decontamination equipment and supplies			
35	Fire extinguishers			
37	Spill cleanup supplies			
Corrective Action Taken During Audit:				

Note: NA = Not applicable

Auditor's Signature

Site Safety Coordinator's Signature

Date

**ACTIVITY HAZARD ANALYSIS (AHA)**

Tetra Tech EM Inc.

(Insert Task Name Here)**Task Description**

This Activity Hazard Analysis (AHA) applies to the task listed above. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required equipment (including safety equipment), inspections, and training. The hazard controls listed below are specific to this task.

Insert a brief narrative description of each task to be completed.

Below, go step by step through the whole process. For each step, identify the potential hazards and describe the "actions" taken to control the hazard (i.e. PPE, lock-out tagout, training, keeping unauthorized parties out of the area, etc.), Example below.

Hazards		Actions
<u>Task Steps</u>	<u>Potential Hazards</u>	<u>Critical Safety Procedures and Controls</u>
<i>Insert additional rows as needed</i>		
<u>Equipment to be Used</u>	<u>Inspection Requirements</u>	<u>Training Requirements</u>

Assessed By_____
Name_____
Signature_____
Date**Approved By**_____
Name_____
Signature_____
Date



ACTIVITY HAZARD ANALYSIS (AHA)

Tetra Tech EM Inc.

Site Inspection

Task Description

This Activity Hazard Analysis (AHA) applies to the task listed above. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required equipment (including safety equipment), inspections, and training. The hazard controls listed below are specific to this task.

Hazards		Actions
Task Steps	Potential Hazards	Critical Safety Procedures and Controls
Conduct visual walk-around of facility	SLIP/TRIP/FALL	<ul style="list-style-type: none"> Wear boots, hardhats, eye protection, Tyvek coveralls, and high-visibility (Class 2) safety vests as appropriate to the hazards encountered. Power and water may not be available. Be prepared with and utilize portable lighting. DO NOT climb tanks, ladders or catwalks unless required by client. Use an ANSI-compliant portable ladder in accordance with SWP 5-11, Portable Ladder Safety. If climbing or walking over 6 feet above the ground, fall protection is required in accordance with SWP 5-10, Fall Protection Practices. Be alert for holes, open pits and other openings in walking and working surfaces. Some openings may be partially covered by debris, pallets, or other items that limit visibility. In areas where oil or other liquid or solid waste materials may be present on ground surfaces, observe ground surfaces that may be slick. If possible, avoid walking on slick surfaces. If slick surface must be crossed, attempt to remove material from soles of shoes or boots before continuing walking. In areas where protective Tyvek booties or other overshoes are required (for example, where waste is present), take short steps and walk slowly to prevent slipping. Always use ladders or stiles to cross fences, ditches, or production lines. In material storage areas, always walk around storage racks or containers, rather than walking on or stepping over racks or containers.
Conduct visual walk-around of facility	EMPLOYEE EXPOSURE	<ul style="list-style-type: none"> Water may not be available. Bring water for hand washing, eyewash, drenching, decontamination and drinking. Attempt to locate MSDS sheets PRIOR to opening containers. A generator and fan are recommended to ensure adequate airflow while opening containers. Handle containers of waste carefully and wear hardhats, safety glasses and gloves as appropriate until the hazards have been characterized. Bring fire extinguishers and stage in work areas. Observe all facility-specific health and safety procedures and exposure alarms, if present.

		<ul style="list-style-type: none"> • Wash hands after conducting the visual inspection and before eating, drinking or tobacco use. • Decontaminate or dry doff to avoid cross-contamination. • Limit time spent in areas where solvents or other volatile organic compounds are being used or have been spilled or released. • Avoid walking in solid waste materials or powders or other dusty areas. • DO NOT walk in or disturb bird or other animal waste or nesting materials. Be alert for animals and insects in debris, under pallets, overhead, etc. • In areas where radioactive materials are in use or are detected, observe and remain out of all “no-go” areas or areas with restricted access and use continuously monitoring and follow ALL action levels. Keep exposure as low as reasonably achievable by limited exposure time, maintaining a safe distance or shielding. • In areas with open containers of waste or raw materials, maintain sufficient distance to minimize the possibility of liquids splashing on exposed skin or inhaling respirable solids. • If heat stress is not a significant possibility, wear long-sleeved shirts and long pants or Tyvek coveralls.
Conduct visual walk-around of facility	STRUCK BY	<ul style="list-style-type: none"> • Wear boots, hardhats, eye protection and high-visibility (Class 2) safety vests as appropriate to the hazards encountered. • In areas where fork lifts or other vehicles are being used, be observant of and avoid all travel corridors. Stay close to facility escorts and follow in a single-file line. • Whenever crossing rail spurs, make sure to stop and look both ways before crossing. • Check for overhead rack lines. When possible, walk around the line rather than under the line. • In areas where empty containers are stacked, maintain a safe distance to minimize the chance of being struck by a falling container.
Conduct visual walk-around of facility	HEAT/COLD STRESS	<ul style="list-style-type: none"> • When inspecting facilities that are likely to have substantial operational areas outdoors, consider predicted high and low temperature and dress in appropriate layers.
<u>Equipment to be Used</u> Gloves, safety glasses, steel-toed boots, hardhat and Tyvek coverall (recommended)	<u>Inspection Requirements</u> PPE prior to use Calibrate and check all monitoring equipment Inspect all tools prior to use	<u>Training Requirements</u> HAZWOPER, first aid, CPR



ACTIVITY HAZARD ANALYSIS (AHA)

Tetra Tech EM Inc.

Hazard Categorization and Sampling of Unknowns

Task Description

This Activity Hazard Analysis (AHA) applies to the task listed above. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required equipment (including safety equipment), inspections, and training. The hazard controls listed below are specific to this task.

Hazards		Actions
Task Steps	Potential Hazards	Critical Safety Procedures and Controls
Site Preparation	SLIP/TRIP/FALL LIFTING – SPRAIN/STRAIN	<ul style="list-style-type: none">• Wear steel-toed, non-skid boots in accordance with Tetra Tech EMI policy.• Establish work zones and restrict unauthorized access.• Prepare the work area and establish emergency equipment, sampling supplies, and a decontamination zone.• Visually inspect the area for slippery spots, trip hazards, spilled chemicals, or debris and correct if found.• Use proper lifting techniques (lift with legs not back). Follow SWP 5-19, Safe Lifting Procedures.• Bring fire extinguishers and stage in work areas.• Ensure water is available for hand washing, eye washing, drenching, decontamination, and drinking.
Container opening and sampling	STRUCK BY PINCH POINTS EMPLOYEE EXPOSURE LACERATION SPRAIN/STRAIN	<ul style="list-style-type: none">• In areas where empty containers are stacked, maintain a safe distance to minimize the chance of being struck by a falling container.• In areas where fork lifts or other vehicles are being used, be observant of and avoid all travel corridors. Stay close to facility escorts and follow in a single-file line.• Develop a sampling plan prior to sampling any containers.• Handle CLOSED containers carefully and wear hardhats, safety glasses and gloves as appropriate until the hazards have been characterized.• Inspect containers to be sampled for signs of pressure, such as bulging or swelling, as well as for leaks and damage.• If a container of unknown material must be opened, avoid lifting or moving it.• When OPENING containers of unknown materials, Level B personal protection, including supplied air, chemical protective clothing and CONTINUOUS monitoring, is required.• Conduct physiological monitoring of personnel PRIOR to donning PPE and during all breaks. Follow SWP 5-15, Heat Illness Prevention and Monitoring.• OPENING of well-labeled containers to confirm that the contents match the label MAY be conducted in a lower level of protection based on the suspected contents with approval from HSD.

		<ul style="list-style-type: none"> • If a container must be moved, use mechanical assistance if possible and clear a path to the new location using a spotter to assist with moving. • Use proper lifting techniques (lift with legs not back). Follow SWP 5-19, Safe Lifting Procedures. • Wear leather work gloves over nitrile surgical gloves when moving AND opening containers. • Open container slowly and listen for sounds of venting indicative of over-pressurization, reactivity, or polymerization. • Handle glass containers and sampling equipment carefully; dispose of any broken glass shards • Have absorbent pads boom and other necessary spill control supplies/equipment nearby to collect spillage that may occur. • In areas with open containers of waste or raw materials, maintain sufficient distance to minimize the possibility of liquids splashing on exposed skin or inhaling respirable solids. • DO NOT stand or lean over other drums or container to obtain samples.
Handling of samples	EMPLOYEE EXPOSURE LACERATION SPRAIN/STRAIN	<ul style="list-style-type: none"> • Handle CLOSED containers carefully and wear safety glasses and gloves as appropriate. • Clean sample jars upon completion of sampling. • Wear leather work gloves over nitrile surgical gloves when moving AND opening containers. • Limit time spent in areas where solvents or other volatile organic compounds are being used or have been spilled or released. • Handle glass containers and sampling equipment carefully; dispose of any broken glass shards
Performing hazard categorization testing of unknown substances	EMPLOYEE EXPOSURE (chemicals and heat) FIRE/EXPLOSION	<ul style="list-style-type: none"> • Handle CLOSED containers to be sampled carefully and wear hardhats, safety glasses and gloves as appropriate until the hazards have been characterized. • Attempt to read all container labels and markings and, if possible, locate and review the MSDS sheets PRIOR to opening containers. • HazCat tests MAY be conducted in a lower level of PPE if monitoring during sampling did not detect hazardous concentrations, flammable, or oxygen deficient/enriched atmospheres. • Use only as much of the unknown chemical as necessary to complete the test. Do not use an ounce of chemical when a single drop will do. • Do not place a hot copper wire directly into sample jar of unknown chemical. • Follow the action levels prescribed in the HASP. • A generator and portable fume hood or fan are recommended to ensure adequate airflow while opening containers. • Handle all chemicals and HazCat reagents carefully to avoid spillage and breakage. • Use appropriate chemical hygiene procedures, including washing hands after conducting HazCat / sampling activities and before eating, drinking or tobacco use. • Observe all facility-specific health and safety procedures and exposure alarms, if present. • Commensurate with the chemicals and hazards present, decontaminate or dry doff as prescribed in the HASP to avoid cross-contamination.
<u>Equipment to be Used</u> Required: Gloves, safety glasses, steel-toed boots, hardhat, chemical protective clothing, APRs, SCBAs, heat stress monitoring equipment, HazCat kit, bung wrench, ratchet, Coliwasa or drum	<u>Inspection Requirements</u> PPE prior to use Calibrate and check all monitoring equipment Inspect all tools prior to use	<u>Training Requirements</u> HAZWOPER, first aid, CPR

thieves, spill control supplies and equipment, air monitoring equipment, eyewash, safety shower, fire extinguishers, and sampling supplies and bottle ware Optional (Recommended): Generator, portable fume hood or fan, portable lighting		
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ACTIVITY HAZARD ANALYSIS (AHA)

Tetra Tech, Inc.

Site Documentation – Observation of Excavation Operations Near Heavy Equipment

Task Description

This Activity Hazard Analysis (AHA) applies to monitoring/oversight of excavation activities at lead sites. It has been developed and approved by the Regional Director of Health and Safety for Tetra Tech, Inc. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required safety equipment, inspections, and training.

Hazards		Actions
<u>Task Steps</u> Site preparation	<u>Potential Hazards</u> SLIP/TRIP/FALL LACERATION	<u>Critical Safety Procedures and Controls</u> <ul style="list-style-type: none"> Visually inspect the area for slippery spots or debris and correct if found Wear steel-toed, non-skid boots in accordance with Tetra Tech policy Ensure all debris has been removed from the path of travel Have a first aid kit available for small cuts Have map showing route to hospital in vehicle
Observation of Excavation Operations Near Heavy Equipment	NOISE HAZARD SLIP/TRIP/FALL HEAVY EQUIPMENT EXCAVATION COLLAPSE/ENTRAPMENT	<ul style="list-style-type: none"> Wear hearing protection Wear steel-toed, non-skid boots in accordance with Tetra Tech policy Wear hard hat and reflective safety vest Be aware of truck traffic on the property or site Stay within equipment operator's field of vision whenever possible Discuss hand signals with equipment operator(s) before commencing work Wear safety glasses and nitrile gloves Have a first aid kit available for small cuts Have map showing route to hospital in vehicle <u>Never enter an excavation unless you have followed the procedures in Safe Work Practice No. 6-4 (Excavation Practices) and know that it is safe to do so.</u> <u>Maintain a safe distance from the edge of an excavation and from heavy equipment near an excavation.</u>
<u>Equipment to be Used</u> <ul style="list-style-type: none"> Level D PPE (steel-toed boots, safety glasses, nitrile gloves, hard hat, reflective 	<u>Inspection Requirements</u> <ul style="list-style-type: none"> None 	<u>Training Requirements</u> <ul style="list-style-type: none"> Personal Protective Equipment Hazardous Waste Operations and Emergency Response (40-hour and current 8-hour update)

<div>safety vest)</div> <ul style="list-style-type: none">• First Aid Kit and eye wash		<ul style="list-style-type: none">• CPR/First Aid (one employee on-site must have current CPR/First Aid training)
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ACTIVITY HAZARD ANALYSIS (AHA)

Tetra Tech EM Inc.

Project Documentation and Air Monitoring

Task Description

This Activity Hazard Analysis (AHA) applies to the task listed above. It has been developed and approved by the Director of Health and Safety for Tetra Tech EMI. The AHA contains potential hazards posed by each major step in this task, lists procedures to control hazards, and presents required equipment (including safety equipment), inspections, and training. The hazard controls listed below are specific to this task.

Hazards		Actions
<u>Task Steps</u>	<u>Potential Hazards</u>	<u>Critical Safety Procedures and Controls</u>
Conduct visual walk-around of facility	SLIP/TRIP/FALL	<ul style="list-style-type: none">• Wear boots, hardhats, eye protection, Tyvek coveralls, and high-visibility (Class 2) safety vests as appropriate to the hazards encountered or anticipated.• Power and water may not be available. Be prepared with and utilize portable lighting.• DO NOT climb tanks, ladders or catwalks unless required by client. Use an ANSI-compliant portable ladder in accordance with SWP 5-11, Portable Ladder Safety.• If climbing or walking over 6 feet above the ground, fall protection is required in accordance with SWP 5-10, Fall Protection Practices.• Be alert for holes, open pits and other openings in walking and working surfaces. Some openings may be partially covered by debris, pallets, or other items that limit visibility.• In areas where oil or other liquid or solid waste materials may be present on ground surfaces, observe ground surfaces that may be slick. If possible, avoid walking on slick surfaces. If slick surface must be crossed, wear boot covers and attempt to remove material from soles of shoes or boots before continuing walking.• In areas where protective Tyvek booties or other overshoes are required (for example, where waste is present), take short steps and walk slowly to prevent slipping.• Always use ladders or stiles to cross fences, ditches, or production lines.• In material storage areas, always walk around storage racks or containers, rather than walking on or stepping over racks or containers.
Conduct visual walk-around of facility	EMPLOYEE EXPOSURE	<ul style="list-style-type: none">• Water may not be available. Bring water for hand washing, eyewash, drenching, decontamination and drinking.• Ensure that all monitoring equipment is properly calibrated and documented PRIOR to site entry.• Utilize air monitoring equipment and follow site-specific action levels in the HASP.• Attempt to locate MSDS sheets PRIOR to opening containers.• Familiarize yourself with the site chemicals of concern and those brought onsite in accordance with the Hazard Communication Program (DCN 2-02)• A generator and fan are recommended to ensure adequate airflow while opening containers.

		<ul style="list-style-type: none"> • Handle containers of waste carefully and wear hardhats, safety glasses and gloves as appropriate until the hazards have been characterized. • Bring fire extinguishers and stage in work areas. • Observe all facility-specific health and safety procedures and exposure alarms, if present. • Wash hands after conducting the visual inspection and before eating, drinking or tobacco use. • Decontaminate or dry doff to avoid cross-contamination. • Limit time spent in areas where solvents or other volatile organic compounds are being used or have been spilled or released or radiation sources are present. • Avoid walking in solid waste materials, spilled powders or other dusty areas. • DO NOT walk in or disturb bird or other animal waste or nesting materials. Be alert for animals and insects in debris, under pallets, overhead, etc. • In areas where radioactive materials are in use or are detected, observe and remain out of all “no-go” areas or areas with restricted access and use continuous monitoring and follow ALL action levels. Keep exposure as low as reasonably achievable by limited exposure time, maintaining a safe distance or shielding. • In areas with open containers of waste or raw materials, maintain sufficient distance to minimize the possibility of liquids splashing on exposed skin or inhaling respirable solids. • If heat stress is not a significant possibility, wear long-sleeved shirts and long pants or Tyvek coveralls.
Conduct visual walk-around of facility	STRUCK BY	<ul style="list-style-type: none"> • Wear boots with boot covers, hardhats, eye protection and high-visibility (Class 2) safety vests as appropriate to the hazards encountered. Use dust masks or respirators as appropriate. • In areas where fork lifts or other vehicles are being used, be observant of and avoid all travel corridors. Stay close to facility escorts and follow in a single-file line. • Whenever crossing rail spurs, make sure to stop and look both ways before crossing. • Check for overhead rack lines. When possible, walk around the line rather than under the line. • In areas where empty containers or other materials are stacked or shelved, maintain a safe distance to minimize the chance of being struck by a falling container.
Conduct visual walk-around of facility	HEAT/COLD STRESS	<ul style="list-style-type: none"> • When inspecting facilities that are likely to have substantial operational areas outdoors, consider predicted high and low temperature and dress in appropriate layers.
<u>Equipment to be Used</u> Gloves, safety glasses, steel-toed boots with boot covers, hardhat, Tyvek coverall (recommended), and dust masks or respirators as appropriate	<u>Inspection Requirements</u> PPE prior to use Calibrate and check all monitoring equipment Inspect all tools, including lights, prior to use	<u>Training Requirements</u> HAZWOPER, first aid, CPR HazCom



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Summary

- This guide is intended to be used for monitoring particulates released from fires. Effects from other potential pollutants and products of combustion are not addressed in this document. [Refer to EPA Emergency Response Air Monitoring Guidance Tables, 2012 Edition 3^a](#) for guidance on other pollutants.
- PM_{2.5} is the preferred metric for fire response particulate monitoring.
- The DataRAM 4 is the standard monitoring instrument for measuring particulate concentrations. Estimations can be expected to be as much as 144% higher than actual concentrations^a.
- The E-BAM, available from ERT, is the alternate monitoring instrument when accuracy is a critical factor.
- Instrument accessories may be needed to offset weather variables and provide power during extended monitoring periods.
- Establish monitoring sites downwind of the hot zone and immediately upwind. Monitoring may also be recommended in the hot zone if there is a health risk to response workers.
- Use Table 1 to select the appropriate response action. Community action levels apply to everyone in neighboring areas affected by smoke. Worker action levels apply to response workers at the site.

Introduction

Fire presents a multitude of health and safety hazards as a result of effects on air quality. Smoke is the most visible air pollutant and is composed of Carbon Monoxide (CO), Carbon Dioxide (CO₂), Water Vapor, Particulate Matter (PM), hydrocarbons, organic chemicals, Nitric Oxides (NO_x), and minerals. Smoke can disperse quickly and may present significant health risks for nearby communities. Variables that impact dispersion include wind, temperature, moisture, and topography. Air monitoring guidance for these and other products of combustion are presented in the [EPA Emergency Response Air Monitoring Guidance Tables^a](#).

PM consists of solid and liquid particles suspended in air. PM can readily enter the body through inhalation and can cause both acute and chronic health effects. Particulates will be present in all smoke resulting from a fire, regardless of the fuel source; however, different types of fuels will produce different sizes and concentrations of PM. Heat is also a factor which can effect particulate concentrations. After a fire has been suppressed, particulate concentrations can be higher during the smoldering phase because of less-complete combustion^b.

Most particulates in smoke are between 0.4 - 0.7 micrometers (µm) which is considered respirable. Particulates are typically classified as PM₁₀ or PM_{2.5} which refers to the particulate size.

- PM₁₀ is defined as “course” particles measuring 10 µm or less in diameter.
- PM_{2.5} is defined as “fine” particles with a diameter equal to or less than 2.5 µm.

It is recommended that monitoring efforts focus on measuring PM_{2.5} during emergency fire responses. The California Air Resource Board states that most smoke particulates are between 0.4 – 0.7 µm, and concludes PM_{2.5} would be a more practical monitoring parameter to use^b. In 2007, Naeher et al. also indicated that PM_{2.5} was the more suitable particulate monitoring metric^c. Further, the EPA Air Quality Index (AQI) uses PM_{2.5} in the health rating guide, also suggesting that PM_{2.5} is the more appropriate standard when looking at the health hazards of particulates.

Links to Additional Information:

- [Graph of particle size distribution of atmospheric particles](#)
- [Graph of particle size from particulate emissions](#)
- [Emission Study with graph of particle size distribution](#)



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Air Quality Thresholds, Actions and Recommendations

Evacuation and/or protect-in-place procedures should be recommended for areas downwind of or in the visible smoke cloud.

Once instrument readings become available, the concentrations may be an indication of potential exposure. Table 1 (for PM_{2.5}) and Table 2 (for PM₁₀) lists the threshold levels for different concentrations and the recommended actions that should be taken to prevent harm to community members and workers/responders at the response site. These actions may include communication with community members, evacuations, and medical monitoring. Consider consulting ATSDR to assist with generating public health statements, factsheets and possible development of a medical monitoring plan.

Criteria listed in the Protective Action Criteria (PAC) were assessed, but the values for particulates were much higher than those used in the AQI^d. Because of this, the PAC values are not the preferred metric for response action guidance.

Odors and visible air opacity may trigger complaints and concerns in affected areas. Conditions and individual sensitivities can play a significant role in determining the point at which smoke becomes noticeable. If such concerns are presented, monitoring instrument results and Table 1 (for PM_{2.5}) and Table 2 (for PM₁₀) recommendations should be used to guide response actions.



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TABLE 1: Threshold Levels and Recommended Response Actions for PM_{2.5}

PM _{2.5} Threshold Levels (µg/m³)		Level of Health Concern	Meaning	Action
1 Hr. Avg. ¹	24 Hr. Avg. ¹			
COMMUNITY ACTION LEVELS				
0.0 – 40.0	0.0 – 12.0	Good	Air quality is considered satisfactory, and air pollution poses little or no risk	Implement communication plan ² .
40.1 – 80.0	12.1 - 35.4	Moderate	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive ³ to air pollution.	Issue public announcement about health effects ² . Stay out of areas with visible smoke.
80.1 – 175.0	35.5 - 55.4	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects. The general public is not likely to be affected.	Recommend evacuation or shelter-in-place for sensitive populations ^{2,4} .
175.1 – 300.0	55.5 - 150.4	Unhealthy	Everyone may begin to experience health effects; members of sensitive groups may experience more serious health effects.	Consider closing schools and cancelling outdoor events. Recommend shelter-in-place for affected neighborhoods.
300.1 - 500.0	150.5 - 250.4	Very Unhealthy	Health warnings of emergency conditions. The entire population is more likely to be affected.	Consider closing schools and cancel all outdoor events. Recommend shelter-in-place and/or evacuation for affected neighborhoods.
> 500.0	> 250.5	Hazardous	Health alert: everyone may experience more serious health effects	Recommend closing schools & cancel outdoor events. Recommend closing workplaces and evacuating affected neighborhood.
Source	Particulates not otherwise regulated/specified (µg/m³)		Meaning	Action
	8 Hr. Avg.			
WORKER ACTION LEVELS				
OSHA PEL	15,000 (total dust) 5,000 (respirable fraction - <10µm)		Safe with use of level D PPE up to this level.	Levels above the 8 hour TWA require the use of level C PPE (use P100 particulate filter). See ERRB P100 – PPE Guidelines for Specific Activities/Tasks and P102 - Respiratory Protection Equipment Selection .
ACGIH TLV	10,000 (inhalable fraction - <100µm) 3,000 (respirable fraction - <10µm)		Safe with use of level D PPE up to this level.	Consider implementing industrial hygiene measures and/or using level C PPE.

¹ Threshold values taken from original EPA AQI online calculator found at http://airnow.gov/index.cfm?action=resources.aqi_conc_calc for PM_{2.5} (24 hour) and Idaho Department of Environmental Quality AQI for PM_{2.5} (1 hour) taken from <http://app.airsis.com/usfs/aqi.asp>.

² Recommendations from EPA Air Now web site. See Reference E.

³ People who are unusually sensitive to air pollution are a subset of Sensitive Individuals. Unusually sensitive to air pollution can be defined as the very young, the elderly, pregnant women, and the immunocompromised.

⁴ Sensitive individuals defined as people with lung disease, older adults and children who are at a greater risk from exposure to ozone; and persons with heart and lung disease, older adults and children who are at greater risk from the presence of particles in the air. See Reference E.



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TABLE 2: Threshold Levels and Recommended Response Actions for PM₁₀

PM ₁₀ Threshold Levels (µg/m ³) ¹			
24 Hr. Avg.	Level of Health Concern	Meaning	Action
COMMUNITY ACTION LEVELS			
0.0 – 12.0	Good	None	Implement communication plan ² .
12.1 – 55.0	Moderate	Unusually sensitive ³ people should consider reducing prolonged or heavy exertion.	Issue public announcement about health effects ⁴ .
55.1 – 155.0	Unhealthy for Sensitive Groups	Increasing likelihood of respiratory symptoms and aggravation of lung disease, such as asthma.	Recommend evacuation or shelter-in-place for sensitive populations ^{2,4} .
155.1 – 255.0	Unhealthy	Increased respiratory symptoms and aggravation of lung disease, such as asthma; possible respiratory effects in general population.	Consider closing schools and cancelling outdoor events. Recommend shelter-in-place for affected neighborhoods.
255.1-355.0	Very Unhealthy	Significant increase in respiratory symptoms and aggravation of lung disease, such as asthma; increasing likelihood of respiratory effects in general population.	Consider closing schools and cancel all outdoor events. Recommend shelter-in-place and/or evacuation for affected neighborhoods.
355.1-425.0	Hazardous	Serious risk of respiratory symptoms and aggravation of lung disease, such as asthma; respiratory effects likely in general population.	Recommend closing schools & cancel outdoor events. Recommend closing workplaces and evacuating affected neighborhood.

¹ Threshold values taken from EPA AQI online calculator found at http://airnow.gov/index.cfm?action=resources.aqi_conc_calc

² Recommendations from EPA Air Now web site. See Reference E.

³ People who are unusually sensitive to air pollution are a subset of Sensitive Individuals. Unusually sensitive to air pollution can be defined as the very young, the elderly, pregnant women, and the immunocompromised.

⁴ Sensitive individuals defined as people with lung disease, older adults and children who are at a greater risk from exposure to ozone; and persons with heart and lung disease, older adults and children who are at greater risk from the presence of particles in the air. See Reference E.



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Monitoring Instruments and Methods

Region IV Emergency Response, Removal and Prevention Branch (ERRPB) currently uses the DataRAM 4 for measuring multiple analytes including particulates. The DataRAM 4 has advantages such as portability, an internal power supply, and a large detection range. One of the drawbacks of the DataRAM 4 is that mass concentrations tend to be over-estimated. United States Forestry Service (USFS) studies have shown that the DataRAM 4 estimations are on average 144% higher than actual concentrations^f. Because of this, the USFS recommends applying a correction factor of 0.39 to instrument readings^f. The DataRAM 4 is the preferred instrument when portability is important and/or if very high concentrations are expected (i.e. at source).

The E-BAM monitor is available through EPA Environmental Response Team (ERT), and is considered to be the most accurate monitoring instrument available. Some of the drawbacks include reduced portability (heavier, awkward shape), narrow detection range, and it requires an auxiliary power source. The E-BAM is the preferred instrument when accuracy is a critical factor and high concentrations are not expected (i.e. better for measuring fugitive dust concentrations on metals removal sites).

Use of monitoring instruments can also be affected by available resources, weather, and environmental conditions. Accessories and adapters may be required to offset the effects of these variables.

- **Heater:** A temperature conditioning heater must be used if humidity is > 65%. Without a heater in these conditions, measurements may be biased towards higher readings. Refer to instrument manual for further instruction. These are available for most particulate monitoring instruments.
- **Power Generation:** Most instruments will run for 15-24 hours on a full battery charge. A generator, solar panel, or auxiliary battery system will likely be needed for equipment without a built-in power supply or for continuous monitoring > 15 hours.
- **GFCI:** If a power generation system is used, a power strip/surge protector should be used to accommodate other accessories and monitoring equipment. This will also prevent possible electrical damage to expensive equipment.
- **Impactor:** The DataRAM can be used with an impactor attachment which connects to the air intake. This functions as a pre-collector to help offset some of the effects of wind and precipitation. It should be utilized any time weather is expected to be a factor.

TABLE 3. Instruments Available for an EPA Response

Criteria	DataRAM 4	E-BAM
Accuracy (% above actual) ¹	144%	1%
Detection Range (µg/m ³) ²	0.1 - 400,000	0.1 - 65,000
Weight (lbs) ₂	13	28 (without battery)
Setup Time	15 min	15-30 min
Measurement Method	light scattering	filter tape
Power Requirements	Re-chargeable internal battery. 24 hr. run time.	Requires AC power source or external DC. Solar option avail.
Availability	Regional Readiness Center	1-2 days via EPA ERT

¹ based on results from US Forest Service 2006 study *Smoke Particulate Monitors*. See Reference F.

² taken from manufacturers specifications.



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Table 4. Comparison of Common Particulate Monitors on the Market

Criteria	DataRAM 4000	DataRAM 2000	E-BAM	E-Sampler	DUSTTRAK
Accuracy (% above actual) ¹	144%	15%	1%	13%	217%
Detection Range (µg/m ³) ²	0.1 - 400,000	0.1 - 400,000	0.1 - 65,000	0.1 - 65,000	0.1 - 400,000
Weight (lbs) ²	13	12	28 (without battery)	12 (without battery)	9 (device only); 38 (with enclosure)
Setup Time	15 min	15 min	15-30 min	15-30 min	Unknown
Measurement Method	light scattering	light scattering	filter tape	light scattering	90 degree light scattering
Power Requirements	Re-chargeable internal battery. 24 hr. run time.	Re-chargeable internal battery. 24 hr. run time.	Requires AC power source or external DC. Solar option	Requires AC power source or external DC. Solar option	Re-chargeable internal battery. 15-24 hr. run time.

¹ based on results from US Sorest Service 2006 study *Smoke Particulate Monitors*. See Reference a.

² taken from manufacturers specs

Monitoring Locations

Monitoring for particulates should take place both at the work zone and in surrounding areas where the smoke may travel or accumulate. Consider areas between the release point and sensitive receptors. Temperature, wind, and humidity can affect where smoke travels. As the earth's surface is heated in the afternoon, the atmosphere becomes more unstable when heated air expands. This causes smoke to disperse in a more vertical pattern in the afternoon and early evening. Warm temperatures or major changes in daytime high/low temperatures will cause the smoke to rise higher than in cooler temperatures with a narrow high/low range. As the atmosphere stabilizes overnight and through the morning, smoke will disperse horizontally and settle into low-lying areas and valleys^g.

Wind is a significant factor in smoke dispersion. Unstable atmospheric conditions in the afternoon also increase wind speed which increases the rate and distance of dispersion. Humidity above 80% can cause moisture to condense on smoke particles. This can create a fog type effect which slows and settles smoke. Precipitation can cause a similar effect and slow dispersion. Atmospheric inversions should be taken into consideration when determining monitoring locations and recommending evacuation or protect-in-place zones. An atmospheric inversion occurs when a layer of air that is warmer than the air below traps the surface air in place and prevents dispersion of any pollutants it contains.

Surface structures such as buildings and trees can significantly change air flow direction and cause stagnant air pockets to form. This can trap smoke in small, confined areas and create hot spots with significantly higher particulate concentrations than nearby locations. When monitoring areas which are surrounding the source consider the following:

- Downwind areas will be most impacted by smoke.
- It should be expected that particulate readings at ground level will be higher at night or in the morning than in the afternoon or early evening.

Monitoring at the work zone may be necessary to establish appropriate levels of PPE for response workers. This will also help to determine safe areas to stage response support activities where workers may not be using protective equipment.



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When choosing a monitoring site, some additional items should also be considered:

- Availability of power sources will determine what type of power generation is required. The absence of auxiliary power will require more frequent maintenance and may require additional staffing, especially if the monitoring period is > 24 hours.
- Consider security measures (i.e. locked boxes, chains, etc.) if instruments are to be sited in public areas and left unattended.
- Ensure generators or equipment from other activities which may release emissions do not interfere with monitoring stations.
- Power lines or electrical utility areas should be avoided.

Health Effects

PM₁₀ and PM_{2.5} are considered to be respirable. Particulates > 10 µm do not typically reach the lungs, but can irritate the eyes, nose, and throat. Although PM₁₀ is respirable, PM_{2.5} is inhaled deeper into lung tissue due to their small size (approximately 1/30th the average width of human hair^h), and thus presents a greater health hazard than larger particulates. PM between 0.1 µm and 1 µm can remain in the atmosphere for days or weeks, meaning there is a potential for long range dispersion from the source.

Smoke and particulate exposure will typically have the largest effect on the respiratory system. Irritation and coughing are common acute symptoms of exposure to particulates. Individuals subject to particulate exposure may first notice irritation of the throat, eyes, and nose. This may be followed by coughing, chest pain, and shortness of breath if exposure continues.

- Acute effects of particulate exposure include irritation of the respiratory system, coughing, and breathing difficulties.
- Chronic effects of particulate exposure include reduced lung function, asthma, lung cancer, chronic bronchitis, cardiovascular disease, premature death, and may cause birth defects^e.

These symptoms can be magnified for sensitive individuals, which can include groups or individuals with pre-existing conditions (e.g.: asthma, heart disease, lung disease), children, the elderly, and pregnant women. Sensitive individuals can experience aggravation of respiratory and cardiovascular systems at lower levels which may not affect non-sensitive individuals^e.

PM can also transport other pollutants which creates additional health concerns. Special consideration and precautions should be made if other pollutants are expected. ATSDR can provide assistance with generating public health statements, factsheets and possible development of a medical monitoring plan.

Reporting

Generate air monitoring summary reports to present data to the Incident Management Team (IMT) during Command, Planning, and Tactical meetings/briefings. Air monitoring summary reports typically group instruments by location and summarize each analyte result with number of readings, number of detections, concentration range, and a time-time weighted average over the period of the report. For particulates, specifically, the air monitoring report typically classifies the reporting period based on the AQI as seen in Table 1 and Table 2.

Develop the reporting schedule around the operational periods established by the IMT, and include sufficient time to review air monitoring summary reports prior to meetings/briefings since they often become the data backing up health-based decisions (e.g. whether to modify/implement evacuation zones or how to advise schools on openings/delayed starts).



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